



PRESIDENT'S MALARIA INITIATIVE



# **Republic of Burundi**

## **National Policy and Strategic Plan on Integrated Vector Management 2012—2017**

### **[Draft]**

Integrated Vector Management (IVM) Task Order 2

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# **Republic of Burundi**

**Ministry of Health**



## **National Policy and Strategic Plan on Integrated Vector Management (2012 - 2017)**

August 2012

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## Acronyms and Abbreviations

AIDS	acquired immunodeficiency syndrome
CDC	US Centers for Disease Control and Prevention
CHWs	community health workers
EAC	East Africa Economic Community
ELISA	enzyme-linked immunosorbent assay
EUVT	End Use Verification Tool
FAO	The Food and Agriculture Organization of the United Nations
GFATM	Global Fund for HIV/AIDs, TB and Malaria
HMIS	Health Management Information Systems
IEC/BCC	Information, Education and Communication/Behavioral Change Communication
IRS	indoor residual spraying
IVM	integrated vector management
LLIN	long lasting insecticide treated nets
MOA	Ministry of Agriculture
M&E	Monitoring and Evaluation
MOE	Ministry of Environment
MOESR	Ministry of Education and Scientific Research
MOPH	Ministry of Public Health
MPR	Malaria Programme Review
NGO	non-governmental organization
NISC	National Inter-sectoral Steering Committee
PNLP	programme national de lutte contre le paludisme (national malaria control program)
PCR	polymerase chain reaction
PMI	US President Malaria Initiative
RBM	Roll Back Malaria
RDT	rapid diagnostic test
RTI	Research Triangle Institute
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
VBD	vector borne disease
VCNA	vector control needs assessment
WHO	World Health Organization
WHOPES	World Health Organization Pesticide Evaluation Schemes

## **Purpose of this Document**

The objective of this policy and strategic document is to guide integrated approaches to the management of the local vectors of vector borne diseases (VBDs) in Burundi. It is targeted at all stakeholders of VBDs:—policy makers who set the national agenda on vector disease control; technocrats who routinely translate national policies into strategies and programs; managers and implementers of VBDs and related vector control programs; developmental partners investing and collaborating with the Government of Burundi for VBD control; private sector partners; all stakeholders whose actions or inactions could either contribute to reduce or increase local transmission of vector borne diseases; and local communities that are at risk of vector borne diseases and are the target of control efforts.

It is anticipated that the document will:

- i. Promote coordinated effort by all stakeholders for ecologically sound, cost-effective and sustainable management of the local vectors of human diseases in Burundi, particularly malaria.
- ii. Clarify national goals and facilitate the development of more comprehensive multi-year work plans on integrated vector management (IVM), thereby providing a framework for forward planning for the allocation of national resources for VBD control.
- iii. Provide an improved context for developmental partners to support national efforts on VBD control.

## **Structure of this Document**

This document is made up of three parts:

Section 1 provides a summary review of the status and justification for IVM in the Republic of Burundi. A summary of the major needs for vector control is provided along with opportunities to improve national efforts.

Section 2 covers policy guidelines for IVM implementation. The section also proposes policy instruments for implementing the IVM policy.

Section 3 presents a national IVM strategy based on the policy framework outlined in Section 2. Relevant national resources required for ecologically sound, cost-effective and sustainable management of the local vector of vector-borne diseases, particularly malaria, are proposed.

## SECTION 1: SITUATIONAL ANALYSIS ON VECTOR CONTROL

### 1.1 Summary of Vector Borne Diseases in Burundi

There are several VBDs in Burundi of which malaria causes the highest burden. This section provides a brief review the status of the VDBs.<sup>1</sup>

#### Malaria

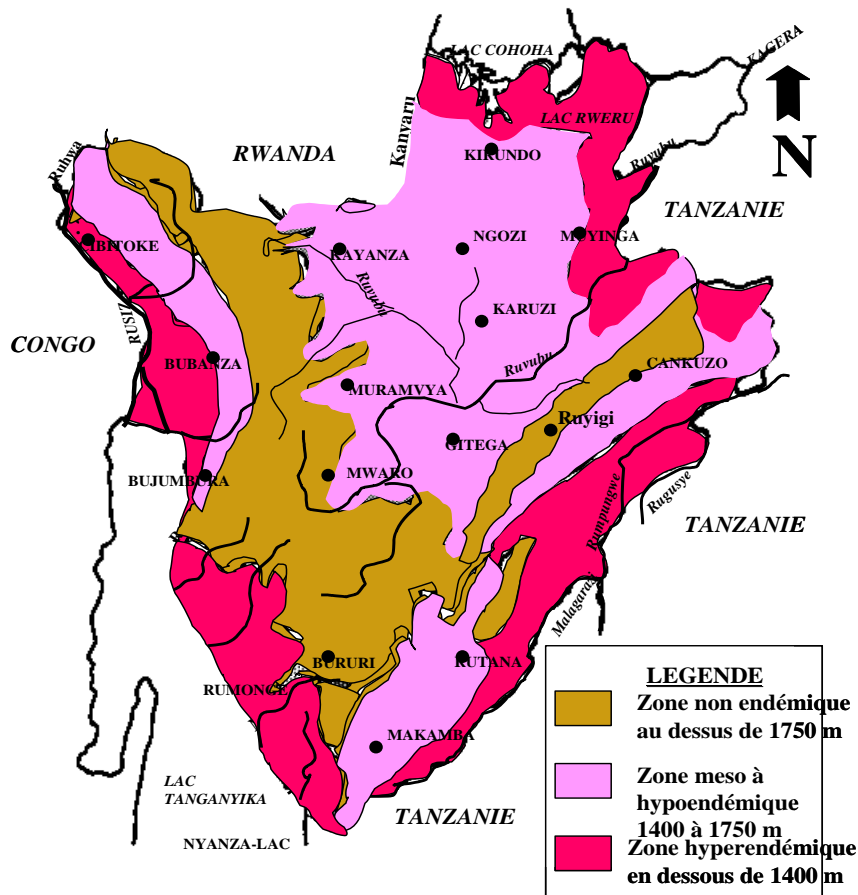
Approximately 80% of the population of 8.7 million is at risk for malaria. The disease is the number one cause of mortality and morbidity in the country. A 2010 Demographic Health Survey found that malaria accounted for at least 60% of outpatient visits and up to 50% of deaths in children under-five years in health facilities. Over four million cases were reported in 2010, representing an increase from 2.2 million cases reported in 2006. There is however some level of uncertainty whether this was an actual increase in new cases or is a result of improvement in diagnosis and increasing access to health care. Nearly 100% of reported malaria cases are caused by the most deadly of malaria parasites, *Plasmodium falciparum*. In 2008, malaria accounted for 5% of deaths in children under-five years, which is a decrease from 8.4% in 2000. Malaria is hyperendemic in areas below 1400m altitude, mesoendemic from between 1,400 to 1,750m altitude and epidemic above 1,750m altitude. About 69% of the country's population live below 1,750m altitudes and account for about 23% of the annual total cases countrywide. Highland areas above 1,750m elevation, experience epidemic outbreaks and account for about 56% of the total annual cases. These include eight of the 17 provinces in the country (Gitega, Karusi, Kayanza, Muramvya, Muyinga, Mwaro, Ngozi and Cankuzo), inhabited by 25% of country's total population (Fig. 1). While the highland areas originally experienced imported cases, the PNLP indicates that about 80% of the cases now occur around the marshes where rice cultivated or mixed farming take place (Pers. Comm., Head, Vector Control Unit/PNLP).

The primary vector is *Anopheles gambiae* s.s, (80% in some places) while secondary vectors include *An. funestus*, (12% reported in some places) and *An. arabiensis*. (PNLP unpublished). The vector profile of the country is however outdated and required an update.

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<sup>1</sup> Reader is encouraged to reference substantive program and annual reports on the various disease for additional details on the disease profiles

Fig. 1: Malaria Endemicity in Burundi (PNLP 2010)



The other vector borne diseases reported to be present in the country are not well studied and their distribution and prevalence not well understood. These include:

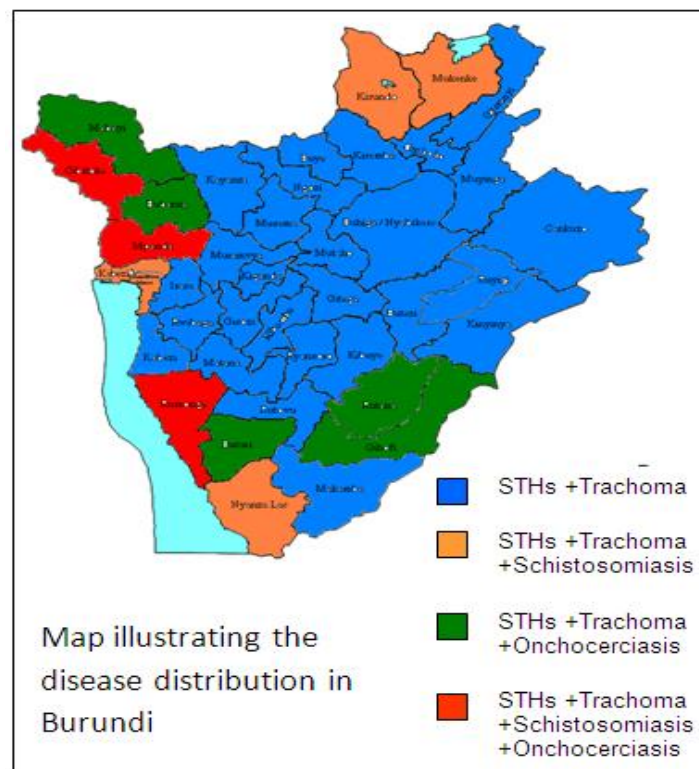
Onchocerciasis: (Fig. 2) Onchocerciasis was first reported in Burundi in the 1970s, and in 2006 1,114,870 people (approximately 12.8% of the population) live meso/hyperendemic areas. The African Program for Onchocerciasis Control has been distributing ivermectin in affected areas since 2005. In 2007 100% of the targeted communities were treated with ivermectin, which was distributed by community directed distributors (CDDs). Upon the formation of the NTD Control Program in 2007, the CDDs were originally targeted to distribute drugs for all NTDs (onchocerciasis, lymphatic filariasis, soil-transmitted helminths, and trachoma) in Burundi. This, however, proved over-burdensome for them, and the drugs for NTDs, other than onchocerciasis,



are now distributed through Mother and Child Health Week, a country-wide health initiative. The map below shows where NTDs are co-endemic in Burundi.

*Fig. 2: Map of NTD co-endemicity in Burundi*

source: <http://www3.imperial.ac.uk/schisto/wherewework/burundi/burundistrategy>



*Schistosomiasis*: In 1985, Lutte Contre la Schistosomiase project implemented a control program in the Rusizi Plain, Bujumbura, the Imbo-Sud and around Lake Cohoha, primarily using chemotherapy. Schistosomiasis is currently endemic, shown in red and orange in the map above, in eight provinces and a baseline survey performed in 2007 across 14 provinces. Prevalence was approximately 5%. Approximately, 3,896,812 people (44.8% of the population) are at risk for schistosomiasis. The Burundian NTD control program, started in June 2007 within the Ministry of Health, has distributed over one million treatments for the disease since 2007. Following one year of treatment, in three study provinces prevalence decreased to 12% in 2007, and to 4% in 2008.

Lymphatic filariasis (LF): Burundi was classified as non-endemic for LF by the WHO in 2010, and the disease is currently not considered a public health problem. Risk for the disease, however, remains due to frequent movement of population to and from Tanzania, where it is endemic. In addition, the vector species is present in Burundi.

Dengue: *Aedes* mosquitoes are present and there is a risk in urban areas, but disease profile in Burundi is unknown.

African Trypanosomiasis: Although the disease was endemic from 1954 onwards, no new cases have been detected for a number of years in the country. Although risk has decreased and there have been no human reservoirs identified, the vector still exists and there may be danger of disease importation from across the border from Tanzania.

LLINs and IRS are the two main interventions currently used for malaria control in Burundi. Investment in infrastructure and related health system strengthening linked to malaria control, could also provide synergistic support to monitor other mosquito borne diseases such as lymphatic filariasis for which the risk for resurgence remains in the country. Using integrated and multi-disease approaches presents an exceptional opportunity to mobilize joint stakeholder efforts to improve overall efficiencies in the utilization of resources for diseases control.

## **1.2 Achievements in Malaria Control**

Burundi is noted for strong governmental support for malaria control. Government has adopted a policy of universal coverage of its populations with a combination of preventive and treatment options. The health care system, however, was severely impacted by the civil war which ended in 2003, and is still fragile. There is a significant need for physical infrastructure and there is a shortage of health workers. In the last 6-8 years, there have been very credible efforts to rebuild the country's health system, expanding access and improving quality of services. For malaria control, actions taken by government include:

- Enhancing malaria diagnosis and case management: Burundi was among the first countries to adopt ACTs. The Government instituted a national policy making access to ACTs free in all public health facilities and there is an aggressive policy to increase the use of rapid diagnostic tests (RDTs), particularly in the peripheral areas and this has improved the rate of confirmed cases. A 2010 malaria review indicated that there are still challenges that negatively impact on timely access to effective treatment. Urgent actions

needed include the development of training manuals and updated treatment flowcharts to minimize the use of anti-malarials, lack of recent therapeutic efficacy studies and absence of a quality assurance system and quality control for laboratories.

- Enhancing vector control and prevention: two main interventions are used and for which government has shown strong commitment to scale up, albeit frustrated by inadequate resources.
  - (i) Burundi adopted the free distribution of insecticide-treated nets (ITNs) in 2004, and in response to updated global recommendations by WHO, changed the national policy to universal coverage in 2006. The policy is to provide an LLIN for every two persons. An aggressive mass distribution campaign has been undertaken to close coverage gap and maintain coverage for vulnerable subpopulations (pregnant women and children) through routine services (i.e. Expanded Program on Immunization and antenatal clinics). By 2009, more than 1.2 million had been delivered to pregnant women and children in Burundi through a Round 2 Global Fund grant. The national malaria control program (PNLP) initiated a nationwide distribution campaign covering all 17 provinces from 2009-2011, distributing over four million LLINs. The Roll Back Malaria Partnership estimates that about 5.76 million insecticidal nets have already been distributed and 979,179 more are scheduled for distribution by the end of 2012. LLINs have also been distributed in cases of malaria epidemics where the affected population is immune to drug treatments. There are plans for LLIN replacement campaigns in 2014.
  - (ii) Indoor residual spraying (IRS) is being used to prevent and control epidemic outbreaks in the highland areas. The IRS operations began in 2006 as a pilot in Ngozi. Spray operations are currently supported under a GFATM grant. Although the 2008-2015 National Malaria control strategy targets a total of eight highland provinces with IRS, there are significant resource constraints frustrating the achievement of the set target. The lack of entomological and epidemiological capacity in the districts imposes a cumbersome validation process to epidemic outbreaks, which slows the speed of response (ref: Section 3.4.2).
  - (iii) There have also been efforts to develop national capacity for entomological surveillance and monitoring. In the first half of 2012 an insectary and associated entomological laboratory space was constructed at Gihanga. Staff of the PNLV Vector

control Unit received training in basic entomological surveillance methods, and some basic equipment was procured, which should enable limited entomological monitoring activity. There are efforts to support the NIPH to set up its ELISA and PCR equipment and to train staff at the laboratory. This should enable in-country capacity to undertake advance surveillance (bio-molecular evaluation of resistance mechanisms, blood feeding index and vector sporozoite rates, etc.). This should enable the development of updated vector profiles and a pesticide resistance management plan.

### **1.3 Addressing the Challenges to Vector Control**

Burundi is still rebuilding its health system that was severely affected by civil conflict. While the strong commitment of government and its people has resulted in significant improvement in the quality of care, especially in the last 6-7 years, there are still significant challenges, including vector control. A robust national framework is needed to enable systematic capacity strengthening of the full range of capacities/competencies necessary for ecologically sound and cost-effective vector control. Table 1 provides a summary of some of the main constraints and opportunities for IVM implementation in Burundi. It includes a need for harmonized policy environment and institutional mechanisms for intersectoral action; creation of national capacity (human and infrastructure) for evidence-based decision making; and empowerment of communities and stakeholders for sustainable, community-based strategies.

Section 2 proposes guidance for a national IVM Policy. Section 3 outlines a strategy to translate the proposed policy into actionable endeavors. It is anticipated that this policy and strategy document will undergo periodic review and update to stay relevant to changing country needs for effective control and prevention of VBDs, particularly malaria.

*Table 1: Major challenges & opportunities for effective vector control in Burundi*

AREA AND MAJOR CONSTRAINTS	OPPORTUNITIES FOR IMPROVEMENT
<b>Policy Environment</b>	
<ul style="list-style-type: none"> <li>• Absence of a harmonized and overarching vector control policy</li> <li>• Inadequate intersectoral mechanism for regular review of the effectiveness/impact of vector policies.</li> <li>• Inadequate translation of strategies into work plans on vector borne diseases (VBDs), particularly outside of malaria.</li> </ul>	<ul style="list-style-type: none"> <li>• Existence of separate sectoral policies that can be enhanced and adapted into an overarching integrated national VBD policy: national health policy, discrete policies for various VBDs, legislation and regulation of pesticides, environmental impact assessment policies current vector control goals</li> <li>• Drafting of a national IVM policy and strategy to provide additional basis for enhancing national policy on IVM</li> <li>• Drafting of national IRS strategy</li> <li>• Establishment of a National Intersectoral Steering Committee (NISC) to sustain policy review mechanisms for create adequacy policy environment for vector control</li> </ul>
<b>Institutional Arrangements</b>	
<ul style="list-style-type: none"> <li>• Absence of either a unified vector control department or coordinated system of units within VBD programs in MOPH for harmonized and cross-cutting joint efforts;</li> <li>• Inadequate framework for coordinating efforts with national stakeholders and with developmental partners</li> <li>• Absence of mandated mechanism inter-sectoral action on vector control;</li> <li>• Need to further harness the full potential of communities for vector borne diseases control</li> </ul>	<ul style="list-style-type: none"> <li>• Implementation of national IVM strategy provides an opportunity to establish framework for intersectoral action at all levels:</li> <li>• Establishment of a national Intersectoral mechanism as part of IVM implementation to enhance collaboration</li> <li>• PNLP and NTD programs have opportunity that can be further explored to create synergies between malaria and lymphatic filariasis control</li> <li>• NSIC to be reflected within the counties to facilitate stakeholder coordination/collaboration</li> <li>• Use of traditional and other community mobilization opportunities (monthly community work) to further empower communities to engage in vector control</li> </ul>
<b>Tools, technologies and logistics of intervention</b>	
<p>Less than maximal deployment of tools</p> <p><u>LLINs:</u></p> <ol style="list-style-type: none"> <li>a. Absence of effective monitoring field performance of LLINs</li> <li>b. Lack of clarity of methods for ongoing/routine LLIN replacement outside of traditional facility based distribution</li> <li>c. Significant dependency on external funding for LLIN procurement and associated uncertainties</li> </ol> <p><u>IRS</u></p> <ol style="list-style-type: none"> <li>a. Absence of critical monitoring such as residual efficacy of IRS insecticides( wall bioassay)</li> <li>b. Uncertainties of funding for scaling up</li> <li>c. Limited capacities within PNLP for IRS</li> <li>d. Cumbersome response mechanism to epidemic outbreaks</li> </ol> <p><u>Larval Source Management</u></p> <p>Absence of a contextualized environmental management strategy including larviciding</p> <p><u>Control of other vector borne diseases</u></p> <ol style="list-style-type: none"> <li>a. Absence/inadequate vector control for other VBDs</li> <li>b. Vertical programs with inadequate collaborations</li> </ol>	<p>Existence of national malaria strategy with coverage targets for IRS and LLINs</p> <p><u>LLINs:</u></p> <ol style="list-style-type: none"> <li>a. Gap analysis in coverage conducted will facilitate planning and resource mobilization</li> <li>b. Opportunity for LLIN field performance evaluation</li> <li>c. Funding and technical support by developmental partners (GF, PMI, UNICEF etc.)</li> <li>d. Opportunity to document lessons from ongoing scale up campaigns to improve best practices</li> </ol> <p><u>IRS</u></p> <ol style="list-style-type: none"> <li>a. Opportunity to use ongoing IRS supported by GFATM to (i) document best practices (ii) build technical capacity in various IRS competencies (iii) develop national scale up plans, including proper costing,</li> </ol> <p><u>Larval source management</u></p> <p>Opportunity to establish limited community based LSM especially within cities to validate cost effectiveness and generate best practices</p> <p><u>Control of other vector borne disease</u></p> <ol style="list-style-type: none"> <li>a. MOPH has initiated efforts, with the support of developmental partners, to address NTDs in the country, beginning with disease mapping in 2012</li> </ol>

**Table 1 (cont'd): Major challenges & opportunities for effective vector control in Burundi**

AREA AND MAIN CONSTRAINTS	OPPORTUNITIES FOR IMPROVEMENT
<b>Entomological surveillance and M&amp;E of vector control</b>	
<ul style="list-style-type: none"> <li>Inadequate national capacity for eco-epidemiological and entomological assessments to support decision making and evaluate outcomes and impact of vector control               <ol style="list-style-type: none"> <li>Absence of sentinel sites</li> <li>Inadequate entomological equipment &amp; supplies</li> <li>Absence of a national entomological surveillance plan</li> <li>Inadequate numbers of field entomology technicians</li> <li>Limited PNLP entomological capacity</li> <li>Need to properly characterize local vectors of malaria and other VBDs and their distribution</li> <li>Unmet need for transmission survey and disease and vector stratification</li> </ol> </li> <li>Need to proactively prevent and manage the development of resistance to WHOPES approved insecticides in local disease vector populations.               <ol style="list-style-type: none"> <li>Inadequate information on existing resistance levels</li> <li>Absence of in-country capacity for assessment of bio-molecular drivers of resistance</li> <li>Absence of a resistance management plan</li> <li>Inadequate national capacity for insecticide quality validation</li> </ol> </li> <li>Inadequate capacity for program monitoring and evaluation due to limited staffing of M&amp;E Unit of PNLP</li> <li>Inadequate clarification of indicators for vector control and M&amp;E strategy</li> </ul>	<ul style="list-style-type: none"> <li>Establishment of a central insectary and associated entomology laboratory at Gihanga presents opportunity to enhance monitoring</li> <li>Laboratory facility in NIPH to support advance entomological evaluations linked to insecticide resistance monitoring</li> <li>Opportunity to collaborate with research and universities, as well as international partners to develop national capacity for epidemic forecasting</li> <li>Previously trained staff on standardized entomological methods (2011), provides basis to build field surveillance capacity</li> <li>Establish entomological sentinel stations linked to existing epidemiological sentinel stations</li> <li>Strengthen staffing and training of M&amp;E unit. Opportunity to mobilize existing competencies in other national institutions to support M&amp;E functions.</li> <li>Adapt existing WHO guidance on IVM and vector control indicators into a national vector control M&amp;E strategy</li> <li>Conduct transmission survey to inform updating of disease stratification</li> </ul>
<b>Funding</b>	
<ul style="list-style-type: none"> <li>Limited funding for vector control and related activities: resources, far below existing needs to scale up vector control to desired coverage levels</li> </ul>	<ul style="list-style-type: none"> <li>Development of multi-year IVM work plans to augment forward planning for in-country budgetary allocation</li> <li>Opportunity to widen scope of funding partnership with developmental partners with clarified and budgeted multi-year work plans</li> </ul>
<b>Human Resources</b>	
<ul style="list-style-type: none"> <li>Inadequate clarification of human resource development policy, as well as job functions/description for vector control, particularly within counties</li> <li>Inadequate human resources and system structures that are critical to integrated vector management</li> <li>Inadequate placement of staffing/competencies, especially within the counties</li> </ul>	<ul style="list-style-type: none"> <li>Committed PNLP leadership.</li> <li>Vector control unit within PNLP with committed staff that could be further trained to strengthen VC competencies</li> <li>CHWs within provinces and districts whose job functions could be augmented to include IVM functions</li> <li>Strengthen capacity of PNLP, provinces and districts for vector control and entomological monitoring</li> </ul>
<b>Community mobilization</b>	
<ul style="list-style-type: none"> <li>Inadequate IEC/BCC</li> <li>Less than desirable community- empowerment and involvement in vector control</li> <li>Less than adequate use of opportunities provided by Community-based Associations (AAC)</li> </ul>	<ul style="list-style-type: none"> <li>Map and enhance use of AACs and CHWs</li> <li>Enhance communication messaging</li> </ul>

## **SECTION 2: POLICY GUIDELINE FOR INTEGRATED VECTOR MANAGEMENT**

Section 2 reviews the policy framework that should drive national transition to IVM. Tools to effectively implement and evaluate the impact of the national IVM policy are summarized.

### **2.1 Vector Control Environment in Burundi**

The Government of the Republic of Burundi exhibits strong political commitment and leadership to reduce the transmission and burden of vector borne diseases, particularly malaria. The following plans all espouse objectives relevant to the control of vector borne diseases: *National Health Policy 2005-2015*; *National Health Development Plan 2006-2010* and *National Strategic Plan for Roll Back Malaria*. In addition, the *National Malaria Control Strategy 2008-2012*, specifically mentions the development of an integrated vector control plan. The strategy set laudable objectives to enhance coordination between stakeholders, community mobilization and empowerment, strengthening of trained personnel, the development of surveillance and monitoring capacities and the establishment of “integrated support systems, including capacity building . . . at all levels” and improve efficiencies in the control of malaria.

The above-mentioned objectives are aligned with the core characteristics of IVM and thus provide a basis to further evolve a more comprehensive and conducive policy environment to facilitate IVM implementation.

### **2.2 IVM Concept and Key Principles**

IVM is defined as, “*A rational decision-making process to maximize the use of resources for vector control*” (WHO 2008). It is currently recommended by WHO as the desirable strategy for ecologically sound, cost-effective and sustainable control of VBDs. IVM has six core principles, which are aimed at cost- effective and sustainable management of the local vectors of human disease. The core principles of IVM are:

- Mobilization of all stakeholders and development of appropriate vector control policies to guide actions.

- Effective collaboration within the health sector and with other sectors, with adequate supporting frameworks for functional collaboration by all stakeholders.
- Creation of regulatory and legislative framework for vector control and to safeguard the environment and human health.
- Integrated approach to the use of tools and methods for rational utilization of available resources, through informed selection of non-chemical and chemical vector tools/methods and multi-disease control approaches.
- Evidence-based decision-making: generate and utilize relevant local data on disease eco-epidemiology to support viable strategies and implementation.
- Capacity-building: strengthen critical infrastructure, financial and human resources at all levels for vector control

This document, therefore, proposes a national policy on IVM that is aimed at establishing appropriate framework for mobilizing coordinated efforts and resources to achieve and sustain national goals on controlling malaria and other vector borne diseases.

### **2.3 IVM Policy Objectives**

The following six policy goals are set to establish an ecologically sound, cost-effective, and sustainable vector control intervention in the Republic of Burundi:

1. Embed policies to prevent or minimize the negative impacts of natural resource development on vector borne diseases, in the development policies of all relevant sectors, organizations and civil society.
2. Establish a national inter-sectoral coordination mechanism to empower and elicit active involvement of all stakeholders, including the private sector, for joint planning, resource mobilization and implementation of vector control activities.
3. Establish appropriate legislative and regulatory regimes for public health insecticides to effectively manage insecticide resistance to promote judicious use, and safeguard human health and the environment.



4. Foster rational decision making in the selection and deployment of vector control interventions. Emphasis will be on generating and managing relevant knowledge of the local disease eco-epidemiology, to promote ecological soundness of interventions, appropriate integration of chemical and non-chemical vector tools/methods and multi-disease control approaches.
5. Create relevant capacities at all levels for an effective management of malaria and other vector borne diseases, including technical human competencies, essential physical infrastructure, and empowered communities,
6. Promote cross-border vector borne disease control initiatives to harmonize and coordinate interventions across the border areas with neighboring countries.

## **2.4 Policy Framework**

The following policy instruments will be utilized to achieve the objectives of the national IVM policy (see Table 2). The focus of the policy instruments will be to:

- Establish procedures for appropriate policy review and changes for IVM implementation. Establish appropriate communication systems and infrastructure to target stakeholders with relevant information. This will include trained human resources and the expansion of standards and harmonized procedures for developing, storing and utilizing relevant data by stakeholders. Establish mechanisms to protect intellectual property rights and link them to the information generated to encourage timely disclosure and sharing of relevant scientific results among stakeholders on vector borne diseases. Stakeholders will be empowered for appropriate changes in attitudes and practices to reduce disease transmission risks.
- Measures will be established to promote the development of appropriate technical human resources at various levels (central and county). Career paths and positions will be created to reduce attrition of trained personnel. There will also be policy instruments aimed at strengthening relevant legislative and regulatory enforcement mechanisms for the procurement, sound utilization and appropriate disposal of vector control products.
- Appropriate institutional framework will be established for inter-sectoral collaboration and joint action on vector control. Efforts will target public sector stakeholders (e.g. MOPH, Ministry of Environment, Ministry of Agriculture). Performance-based review systems will

be developed to appropriately recognize and reward collaboration and entrench a culture of joint action.

- Relevant infrastructure (e.g. insectaries, laboratories, harmonized protocols, integrated information management systems) will be established to generate local evidence on disease eco-epidemiology for decisions making. Priority operational research and close collaboration with regional and other external centers of excellence will be promoted to address knowledge gaps in local eco-epidemiology of malaria transmission. Surveillance, monitoring and program evaluation will be prioritized to determine the distribution and levels of vector borne diseases, as well as the outcomes and impact of interventions and strategies.

*Table 2. Enabling policy instruments for IVM implementation*

<b>Key element of IVM</b>	<b>Policy objective</b>	<b>Policy instrument</b>
Advocacy, social mobilization	Political and administrative hierarchy involved in advocacy through meetings and mass media campaigns	<ul style="list-style-type: none"> <li>• Government position statement on IVM</li> <li>• Mass media support for IVM</li> <li>• Support IEC/BCC for vector control</li> <li>• Support local and World Malaria Day</li> </ul>
	Sector stakeholders and developmental partners empowered to rationalize contribution	<ul style="list-style-type: none"> <li>• Develop level appropriate IEC/BCC and partner opportunities</li> <li>• Develop information sheets clarifying national and program objectives, strategies, lessons achievements/impact and needs</li> </ul>
	Communities empowered to participate in vector control	<ul style="list-style-type: none"> <li>• Support community based services through CHWs</li> <li>• Community awareness and education programs through IEC/BCC</li> <li>• Support decentralization in decision making</li> <li>• Provide incentive programs for community participation in vector control</li> </ul>
Legislation and regulation	Effective legislation and regulation in place	<ul style="list-style-type: none"> <li>• Augment and enforce legislation and regulation on pesticide management</li> <li>• Enforce legislation and regulation on environmental management</li> <li>• Enforce compliance with environmental impact assessment in development projects</li> <li>• Encourage subsidies and tax exemptions on vector control products</li> <li>• Develop best practices for vector control</li> </ul>
Collaboration within the health sector and with other sectors	Intra-sectoral collaboration achieved within the health sector	<ul style="list-style-type: none"> <li>• Ministerial position statement on IVM</li> <li>• Directive on collaboration between health divisions and units</li> <li>• Revise job descriptions</li> </ul>
	Inter-sectoral collaboration achieved with other sectors and partners	<ul style="list-style-type: none"> <li>• Government position statement on IVM</li> <li>• MOPH facilitate and endorse VCNA report</li> <li>• Establish national inter-sectoral steering committee (NISC) on IVM</li> <li>• Establish a vector control working group (VCWG) as one of the technical sub-committees of NISC to concentrate on deployment of tools and methods entomological surveillance</li> <li>• Designate an IVM focal point</li> <li>• Facilitate inter-ministerial meetings</li> <li>• Facilitate institutional arrangements and framework for IVM</li> <li>• Compliance with Health Impact Assessment by sectors</li> <li>• Facilitate cross-border high level planning meetings on vector borne diseases control</li> </ul>

*Table 2 (cont'd). Enabling policy instruments for IVM implementation*

<b>Key element of IVM</b>	<b>Policy objective</b>	<b>Policy instrument</b>
Integrated approach to tools and methods, as well as multi-disease approaches	Efficiency and effectiveness of multiple diseases control achieved	<ul style="list-style-type: none"> <li>• Directive on joint planning and implementation of vector control within and outside the health sector</li> <li>• Performance based recognition/reward for collaboration</li> <li>• Allocation of resources for M&amp;E</li> </ul>
	Generate local evidence on cost-effectiveness and added impact of IRS in the context of universal coverage with LLINs	<ul style="list-style-type: none"> <li>• Allocation and strategic direction for operational research on country-specific programmatic issues</li> <li>• Encourage networking with local and international research organizations</li> <li>• Support reporting, documenting and publication of findings/lessons</li> </ul>
	Encourage appropriate larval source management at the community level - and recognize settings where it is not appropriate	<ul style="list-style-type: none"> <li>• Evaluation of full utility of larval source management to control breeding of mosquito vectors</li> <li>• Community based/involvement in larviciding and environmental management</li> <li>• Community education on vector control</li> </ul>
Evidence-based decision making	Efficient epidemiological and entomological surveillance undertaken	<ul style="list-style-type: none"> <li>• Allocation of resources for strong surveillance systems through sentinel sites</li> <li>• Support laboratory services for entomological monitoring</li> <li>• Support decentralized decision making</li> <li>• Strengthen data management system (integrate into HMIS) and reporting for decision making</li> <li>• Allocation of resources for strategic direction on operational research on vector control</li> <li>• Allocation of resources for M&amp;E on impact of vector control on disease transmission</li> </ul>
Capacity building	Ensure a critical mass of vector control specialists at national and county levels	<ul style="list-style-type: none"> <li>• Allocation for human capacity building and clarified career paths</li> <li>• Allocation for IVM training curriculum at all levels</li> <li>• Promote decentralized decision making on appropriate vector control interventions at county level</li> <li>• Revise job descriptions to include vector control</li> </ul>
	Strengthen infrastructure for epidemiological and entomological surveillance	<ul style="list-style-type: none"> <li>• Allocation of resources for infrastructure development</li> <li>• Re-organize and appropriately staff the PNLN to address other VBDs</li> <li>• Support exchange and sharing of human and infrastructure resources between sectors</li> <li>• Facilitate inter-sectoral budgeting for IVM</li> </ul>

## 2.5 Policy Implementation Plan

The policy instruments and expectations outlined above are prioritized and divided into categories of expected activities and related outputs in Table 3. The activities will be implemented to achieve the set objectives.

*Table 3. Expected outputs and indicators on policy implementation*

<b>Expected outputs</b>	<b>Activities</b>	<b>Time frame</b>	<b>Indicators</b>	<b>Partners</b>
1. Advocacy—high level political, administrative and scientific campaigns for IVM achieved	Engage policy makers, civil society and media in IVM advocacy; conduct stakeholders validation of IVM strategy	Dec 2012	IVM Strategic Plan adopted by stakeholders	MOPH, stakeholders, media
	Resource mobilization	Continuous	Funds available for vector control	Ministry of Health and Social Welfare, other sectors and partners
	Develop IVM training curriculum for basic and mid-level personnel drawn from all relevant sectors	Feb 2013	IVM training modules available for Trainers of Trainers	PNLP, stakeholders
2. Capacity building—national and county capacities for IVM built and strengthened	Develop career path and incentives for IVM personnel	Continuous	Critical mass of expertise in entomology, epidemiology, and vector control appropriately developed at all levels	PNLP, main stakeholders
	Clarify job functions/descriptions at various levels			
	Strengthen infrastructure for public health entomology	Continuous	Fully functional entomology laboratory	PNLP
		March 2013	Fully functional PCR and ELISA lab at NIPH	NIPH, PNL development partners
3. Community empowerment—community involvement in personal protection and vector control strengthened	Enhance community awareness and education programs	Continuous	Number of farmers and communities actively engaged in vector control	CHWs, farmers, local leadership, NGOs, civil societies
	Encourage decentralized decision making in vector control	Continuous	Develop plans detailing decision making responsibilities at various levels	PNLP, Health facilities, County Health Teams
	Prescribe incentives for participation in vector control	Continuous	Performance based appraisals	All sectors

<b>Expected outputs</b>	<b>Activities</b>	<b>Time frame</b>	<b>Indicators</b>	<b>Responsibility</b>
4. Collaboration between the health ministry and other sectors achieved	Establish a national inter-sectoral steering committee (NISC) for IVM	Jan 2013	Inter-sectorial meetings	Ministry of Health and Social Welfare, PNLP, sectors
	MOPH issues a position statement on IVM	Dec 2012	An IVM position paper available	MOPH
	MOPH issues directive for all relevant department and units within the Ministry to collaborate	Dec 2012	Shared resources	Ministry of Health and Social Welfare, PNLP
	Allow institutional arrangements for IVM	March 2013	Policy adjustments towards vector control	All sectors
	Hold inter-ministerial meetings on VBDs control	Bi-annual	Approved joint work plans for vector control	All sectors
	Initiate cross-border collaboration	Annual	Joint work plans for vector control	EAC health ministers meetings
5. Evidence-based decision making—vector control interventions	Facilitate entomological and epidemiological surveillance	Continuous	Data available, utilized and published	PNLP, research organizations, partners
	Support staff to undertake operational research on programmatic issues of vector control	Continuous	Number of projects that generate new evidence for decision making	NISC, VCWG, PNLP, universities and research organizations
	Establish functional entomology sentinel sites in primary eco-epidemiological zones	December 2012–Dec 2013	Number of sentinel sites routinely engaged in ento-monitoring and reporting	PNLP, provincial and district administrations, developmental partners
6. Integrated approach—combinations of vector control interventions undertaken	Conduct operational research on efficiency and cost-effectiveness of chemical and non-chemical methods of vector control	Continuous	Best practices for vector control adopted	PNLP, universities, research organizations
7. Enforce legislation and regulations for vector control	Ensure sectors and development partners undertake environmental impact assessment before development projects are commissioned to mitigate vectors proliferation	Continuous	Environmental impact assessment	All sectors and development partners, MOE, MOPH, PNLP, MOA
	Ensure compliance with legislation and regulation on pesticide use and management	Continuous	Insecticide resistance management strategy	MOPH, MOA, MOE
	Ensure compliance with legislation and regulation on environmental management	Continuous	Environmental impact assessment	MOE, MOPH, PNLP
	Tax exemptions for vector control products for public sector and non-profit making initiatives	Continuous	Tax relief on pesticides and personal protection equipment	Ministry of Finance, national legislature

## SECTION 3: STRATEGIES FOR INTEGRATED VECTOR MANAGEMENT

Section 3 describes the broad strategies to be implemented to achieve the IVM objectives outlined under Section 2.3. Procedures that will be used are outlined for the policy instruments that are associated with the objectives as described in Section 2.4 (Table 2). This IVM strategy is intended to provide boundaries and end-goals to inform subsequent elaboration of detailed and costed work plans (annual or bi-annual and over the life of the 5-year strategy), and enable milestones to measure progress made in national transition to IVM.

### 3.1 Advocacy and Social Mobilization for IVM

A core principle of IVM is effective stakeholder participation; all stakeholders will be empowered with appropriate information to facilitate informed decisions and effective participation. The PNLP will coordinate IVM advocacy and communication, under the guidance of the mandated NISC and in consultation with major primary stakeholders (e.g. MoE, and the relevant departments and programs within MOPH, such as the National Health Promotion Division). There will be advocacy and communication targeting various stakeholder groupings, which will be tailored to suit the roles and responsibilities the groups will have in the partnership endeavors:

- Policy makers: In spite of the noted commitment of central government for IVM, it is important that A/C continue to sustain an enabling environment. A/C to this group will aim at informing on the successes, benefits, experiences, and lessons, as well as the requirements and needs for IVM. Projecting funding requirements elaborated through IVM work plans will guide forward planning and in-country resource allocation.
- Technical staff implementing intervention: These will target all levels—central, county and community. The A/C will have level-appropriate technical and non-technical information to promote sound decision making at the various program administration levels.
- Communities and general public: A/C to this group will aim at empowering and eliciting proactive participation in IVM activities. A/C will normally be in local dialects and conducted through various public media, group meetings and direct personal communication by implementing stakeholders. A/C will include information on IVM, the interventions

implemented; the roles and responsibility to the target group, including clarifying compliance issues for communities and households.

- Private sector stakeholders: A/C shall solicit participation and contribution (technical, financial, materials and supplies, etc.) to the IVM implementation, either at national level or usually to promote workplace and corporate social responsibility contribution in the business catchment areas.
- Donors and developmental partners: A/C efforts will aim to inform and promote effective resource mobilization and technical cooperation. Advocacy will normally cover the goals, priorities and work plans, intervention and methods utilized, progress on IVM implementation, contributory outcomes/impact as appropriate and feasible, as well as gaps in funding and other resources.

#### Major Action Points:

- The NISC to provide overall guidance to all aspects of IVM implementation.
- The PNLP to provide day-to-day leadership to A/C efforts, with close consultation and input from relevant stakeholders, especially those with noted IEC/BCC expertise. Every possible effort will be made to solicit and sustain the involvement of mass media.
- The PNLP will work with partners to integrate appropriate BCC/IEC in their vector control interventions.
- The following will be targeted to assist with empowering communities for IVM: mosques, churches, community health workers, rice farmers, brick makers, local authorities, schools, and local environmental committees.
- The PNLP and all stakeholders will participate in mobilization of human and financial resources towards advocacy for vector control.

#### Indicators:

- Advocacy meetings on IVM at the national and county level in place.
- Advocacy materials for IVM produced targeting various stakeholder groupings
- Number of targeted stakeholders that have allocated resources for vector control.
- Number of targeted communities/administrative areas that have received advocacy information on IVM.
- Number of targeted communities mobilized and engaged in vector control.



### **3.2 Legislation and Regulation for IVM**

An appropriate legislative and regulatory environment is important for effective national scale-up of vector control. The objective of such legislation and regulation (L&R) are two-fold:

L&R will aim to prevent or mitigate negative impacts from human activities on local disease transmission. Human activities such as irrigated agriculture, dams, sand weaning, road construction and other building projects may inadvertently create significant breeding habitats that can alter the local transmission of vector borne diseases. Currently there are regulations in Burundi stipulating the conduct of an environmental impact assessment prior to any major developmental project. Opportunities to further strengthen these regulations by ensuring adequate consideration of health impacts and inclusion of safeguards against diseases will be fully explored.

The second broad aim of L&R in vector control is to protect the environment and human health against potential adverse effects from improper handling and non-recommended use of public health insecticides. Effective management of public health insecticides is a basic requirement for deploying any insecticide-based intervention. Public health insecticides will be fully regulated to protect human health and the environment. Comprehensive assessment of the adequacy of existing national legislation and regulations covering the use of public health insecticides will be made and appropriately strengthened and enforced. Existing procedures for registering, licensing and importation of WHOPES approved insecticides for IRS, larviciding and other vector control products will be reviewed periodically and updated. Criteria for approving local vendors of public health insecticides will include capacity of the vendor to communicate appropriate information on the handling, safe use and disposal of their insecticide products.

The widespread use of an insecticide for vector control will be preceded by a detailed risk assessment of the potential risks to human health and the environment, peculiarities of the intended ecological zone or operational area, and the verifiable implementation of safeguards. This will be to ensure compliance with the national regulations on public health insecticides, as well as relevant recommendations of the WHO and FAO. The selection of specific public health insecticides for broadcast use in any vector control intervention (e.g. IRS, larviciding) will provide clear rationale for the selection including adequate consideration of impact on pre-existing tolerance or resistance in vector populations in targeted areas and potential handling

risks. There will be appropriate educational, advisory, extension and health-care services linked to use of insecticides for vector control. The following will be specifically addressed:

- a. Relevant pesticide management laws, regulations and institutional arrangements will be regularly reviewed by mandated entities (MOA, MOE, PNLP etc) and updated to provide adequate protection of human health and the environment in vector control operations. The MOPH and partners will establish a framework, involving the police and other relevant agencies, for national enforcement of regulations on public health insecticides. Penalties for breaking laws regulating the use of insecticides will be clarified and broadcast, and access to public health insecticides will, at all times, be restricted to authorized persons and institutions.
- b. Selected insecticides for vector control will be procured with the full involvement and consent of PNLP and MOE, from certified manufacturers and/ or their authorized local agents. There will be verifiable chain of custody within country, and country capacity for assuring the quality of procured insecticides will be enhanced in collaboration with advanced laboratories.
- c. All categories of insecticide handlers, particularly spray operators and drivers, will be appropriately trained and certified on best practices covering the whole insecticide life cycle—including storage, transportation, end-use and disposal. All spray operators must be certified based on completion of stipulated training or periodic refresher training. Insecticide handlers (transporters, store keepers, spray operators, etc) will use approved personal protective equipment (PPE) at all times during the handling of insecticides.
- d. Harmonized pesticide storage and inventory practices will be established and informed by national regulations and relevant recommendations of WHO and FAO. There will be a certification scheme for all insecticide application equipment.
- e. The broadcast use of insecticides in vector control (e.g. IRS, larviciding) will involve environmental compliance inspections as an integral part of programming to monitor field operations and promptly correct anomalies.
- f. Health facilities in the target areas will be selected and equipped as reference points for insecticide poisoning.

### 3.3 Collaborative Arrangements for IVM

The local drivers of VBD transmission are multivariate and often cut across sectors—beyond the purview of the health sector alone. Hence to address them effectively, cross-sectoral action is necessary. An NISC, under the leadership of the MOPH, to promote a multi-sectoral approach to vector control, ensuring that non-health sectors such as agriculture and environment play proactive roles to fully address disease transmission.

The NISC will provide appropriate oversight and guidance to the IVM process. Two levels of coordination are critical for successful implementation of IVM:

- (i) Collaboration within the health sector (i.e programs, departments and division). Division within MOPH with mandate on environmental & occupational health, community health; epidemiology; neglected tropical diseases and National Health Promotion Division, are seen as partners to PNLDP. There should be effective mechanisms to facilitate communication and collaboration. .
- (ii) Inter-sectoral collaboration among sectors (e.g. Agriculture, Environment, Infrastructure) and other national stakeholders (communities, private sector and other non-governmental groupings, etc.). It is necessary that sectoral and stakeholder functions and roles are clarified to foster transparency and accountability in the collaboration.

#### Functions of the National Inter-sectoral Steering Committee (NISC)

The mandate of the NISC will include the following:

- i. Review national policies that are relevant to vector borne diseases control and develop a harmonized overarching national policy and strategies for their control.
- ii. Provide oversight and coordination to the implementation of national IVM strategy and work plans, ensuring ecological soundness, cost-effectiveness, and sharing of lessons learned and experiences.
- iii. Facilitate rationalized roles and responsibilities among stakeholders and evolve mechanisms to ensure accountability.
- iv. Provide leadership and coordination to mobilization of resources for inter-sectoral action, ensuring transparency and accountability.

- v. Undertake regular review of the implications of policies, strategies and work plans on VBDs and make recommendations to government and appropriate authorities to enhance the achievements of national objectives on vector control.
- vi. As required, establish working groups drawing upon national and international expertise to address priority issues of concern through operational research or surveys.
- vii. Create opportunities for generating broad-based national consensus on issues and ensure that the genuine concerns of at-risk populations and communities are adequately considered.

*Table 4. Potential stakeholders and anticipated roles in vector control*

<b>Sector/Department</b>	<b>Roles in vector control</b>
<i>Ministry of Health</i>	<i>Provide leadership on IVM policy and strategy, and disease information, tools procurement, intervention implementation, impact assessment</i>
<i>Ministry of Agriculture</i>	<i>Advise farmers on best practices for rice cultivation and pesticide use</i>
<i>Ministry of Public Works</i>	<i>Ensure compliance in housing, roads, dams and other infrastructure; ensure public health sanitation; promote and advocate vector control mitigation in resource development</i>
<i>Ministry of Information and Communication</i>	<i>Support the development of communication strategy and community mobilization</i>
<i>Ministry of Water, Energy and Minerals</i>	<i>Ensure compliance and conservation in resources development; gather climate data for forecasting and prediction</i>
<i>Ministry of Education and Scientific Research</i>	<i>Create awareness on vector borne diseases control</i>
<i>Ministry of Planning and Economic Affairs</i>	<i>Ensure financial sustainability towards vector control</i>
<i>Ministry of Economy, Finance and Development</i>	<i>Implement tax exemption and tariffs on public health products including mosquito nets</i>
<i>Ministry of Environment</i>	<i>Ensure environmental and pesticide policies are followed. Ensure compliance with international standards on various insecticide products, sound disposal; promote and advocate vector control mitigation in develop through environmental health impact assessments</i>
<i>Ministry of Regional Integration and EAC Affairs</i>	<i>Facilitate cross border initiatives on vector control</i>
<i>NGOs: USAID/PMI, WHO, FAO, UNEP/GEF, GFTAM</i>	<i>Technical and financial support for vector control</i>
<i>Private sector</i>	<i>Collaboration and support for vector control</i>
<i>Research and training institutions</i>	<i>Operational research and training in vector control</i>
<i>Local NGOs: farmer-</i>	<i>Promote end use compliance of insecticide and environmental</i>

<i>cooperatives, civil societies</i>	<i>management best practices among targeted communities</i>
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A perennial challenge to the NISC will be a need to balance sectoral/partner expectations with the broader national VBDs goals and ensure that VBDs risks are given appropriate consideration. This means the NISC needs appropriate mandate to ensure partner compliance and accountability to human health and environmental safeguards enshrined in legislation or regulation. The NISC will also need to ensure that individual partner agendas fit and are integrated into overall national strategic objectives. Roles and responsibilities of stakeholders must be established to facilitate collaboration (Table 5). The central level inter-sectoral arrangements will be reflected within provinces and districts to enable effective joint action on at all levels for vector control.

*Table 5: Potential functions and roles for inter-sectoral action in health*

<b>Health Sector Functions</b>
<ul style="list-style-type: none"> <li>• Periodic eco-epidemiologic evaluation &amp; surveillance,</li> <li>• Document and disseminate lessons</li> <li>• Update priority R&amp;D needs and agenda</li> <li>• Establish and update institutional and operational frameworks</li> <li>• Harmonize relevant sectoral policies and legislation</li> <li>• Evaluate policy, institutional and operational framework</li> <li>• Identify sector-specific vector control measures, quality control of activities and monitor compliance</li> <li>• Capacity building</li> </ul>
<b>Functions of Other Sectors</b>
<ul style="list-style-type: none"> <li>• Include health criteria in sectoral operational frameworks and procedures</li> <li>• Undertake health impact assessment for new development projects and ensure the implementation of mitigation measures proposed for potential negative health impact</li> <li>• Implement vector control measures in line with sectoral mandates</li> <li>• Participate in joint activities</li> <li>• Inform health sector on new technical and project developments</li> </ul>

The NISC will absorb existing committees on major interventions, such as the IRS Task Force and LLIN Coordination Committee, as substantive subcommittees. The NISC will also pool relevant stakeholders into *ad hoc* subcommittees around focal issues to support IVM implementation. The areas may include entomology, epidemiology, environmental management, and program management. Specialists in these ad hoc sub-committees will work

under the day-to-day leadership of the PNLP to complete assignments. They will advise on the management of VBD programs; make recommendations to enhance national policy for VBDs; provide technical support to the organization, monitoring and evaluation of national programs; and support training of intermediate level staff and conduct priority research on VBDs. At the national level the PNLP will provide overall strategic and technical guidance to county level planning, implementation, monitoring and evaluation of the IVM strategy, ensuring a multidisciplinary, multi-disease approach and proactive inter-sectoral action.

Major Action Points for inter-sectoral collaboration

- The MOPH will lead the development of a formal mandate, terms of reference and commissioning of an NISC to oversee the national implementation of IVM.
- The MOPH will appoint a senior level staff for the NISC and identify major stakeholders to invite as members. Each member-sector and organization of the NISC shall appoint a senior staff representative.
- The NISC will oversee collaboration among stakeholders on control of malaria and other vector borne diseases and evolve criteria for recognizing stakeholders who excel in collaborative efforts.
- The MOPH will promote adequate consultations on the national IVM Policy by all stakeholders.
- The PNLP will recruit at least two senior entomologists to incorporate capacity into the NISC to address other vectors apart from malaria vectors. As needed, entomologists in other sectors will also be mobilized to support specific vector control efforts.
- The PNLP will facilitate development of provincial and district work plans for IVM, with active involvement of the provinces and districts.

Indicators:

- National IVM Policy and Strategy in place.
- The PNLP addressing all VBDs in the country.
- Number of institutions and stakeholders that participate in vector control activities.
- Fully functional NISC.
- Number of counties that have annual work plans for IVM.

### Major Action Points for NISC

- The MOPH and PNLP will identify stakeholders and potential partners within and outside the health sector and agree with partners on anticipated roles in vector control.
- The partners and stakeholders will designate senior staff representation to the NISC. The representative should be senior enough to make decisions on behalf of their respective institutions and ensure partner commitment and implementation of NISC decisions.
- The PNLP and NISC will establish a technical vector control working group (VCWG) to monitor field performance tools and methods, follow-up of actions such as operational research.
- The NISC will designate an IVM focal point for day-to-day operations on IVM. The focal point will be staff of PNLP.
- The MOPH and NISC will organize regular formal and informal consultation meetings with all key stakeholders to discuss relevant issues, provide feedback, strategic orientation, technical support and resource mobilization for vector control.
- The NISC will identify and build the necessary technical capacity of the partner sectors to ensure participation and sustainability of desired actions within those sectors.
- The MOPH and NISC will facilitate cross-border collaboration for disease surveillance and control.

### Indicators

- A technical vector control working group (VCWG) in place.
- A national IVM focal point in place.
- Number of joint planning sessions held with communities, MOPH and other stakeholders.
- Number of target subjects of training identified amongst collaborators.
- Number of non-health sectors contributing resources towards vector control.
- Number of senior level meetings held with neighbouring countries for joint planning and implementation of vector control across the borders.

## **3.4 Vector Control Methods**

Table 6 summarizes the different interventions targeting vectors and the diseases they cause. Some interventions may impact vectors of more than one disease, especially where the diseases share a common vector, or the different vectors have similar behaviours (feeding and/or resting) which can be exploited by an intervention (e.g. LLINs or IRS targeting indoor feeding and indoor resting mosquitoes). A multi-disease approach to disease control is therefore recommended where such diseases co-exist in the same geographical area. Separate disease control programs will then need to coordinate joint planning and implementation to enhance synergies and maximize resources.

*Table 6. Vector control interventions and diseases generally targeted*

Type	Interventions	Target vectors	Diseases normally targeted.
Chemical	LLINs	Mosquitoes, bedbugs, lice	Malaria, filariasis, typhus
	IRS	Mosquitoes, fleas, cockroaches	Malaria, filariasis, plague
	Larviciding	Mosquitoes, black flies	Malaria, filariasis, onchocerciasis
	Space spraying	Mosquitoes, tsetse flies	Malaria, filariasis, dengue fever, trypanosomiasis
	Household products	Mosquitoes, house flies, fleas, cockroaches	Malaria, filariasis, plague, trachoma
Mechanical	House screening	Mosquitoes, house flies	Malaria, filariasis, trachoma
	Baited traps	Tsetse flies, cockroaches	Trypanosomiasis,
	Sticky paper traps	Sand flies, houseflies	Leishmaniasis, trachoma
Biological	Larvivorous fish	Mosquitoes	Malaria, filariasis,
	Predators	Mosquitoes, snails	Malaria, filariasis, schistosomiasis
Environmental	Environmental management and sanitation, habitat management	Mosquitoes, snails, tsetse flies, house flies, cockroaches	Malaria, filariasis, dengue fever, schistosomiasis, trypanosomiasis, trachoma

The main vector control interventions in Burundi are LLINs and IRS.

### 3.4.1 Long Lasting Insecticidal Nets (LLINs)

The use of LLINs is recommended in all malarious areas, especially to protect children, pregnant women and socio-economically vulnerable groups. Burundi has set a universal coverage goal of one LLIN for two persons. Section 1 very briefly highlights LLIN achievements to date. Routine services, such as ante-natal clinics (ANC) and the expanded program on



immunization (EPI) will continue to be high priority and complementary modes of LLINs distribution, ensuring the maintenance of full coverage of vulnerable populations (pregnant women and children). Mass campaign efforts will particularly ensure access to disadvantaged households and institutions. A longitudinal study will be initiated and maintained to monitor and evaluate the field performance of distributed LLINs. The study will monitor knock down, insecticide content and physical condition of the nets to enable proper determination of replacement regimes and related public advisories of the different types of LLINs in use in the country. IEC/BCC efforts will be intensified to achieve and sustain high utilization rates for LLINs. Forecasting capacities will be strengthened at all levels, while procurement planning and resource mobilization for LLINs will be enhanced, to ensure sustained universal coverage

#### Major Action Points for LLIN Implementation

- The PNLP to develop national LLIN strategy and guidelines for LLIN distribution to sustain distribution and utilization targets for universal coverage.
- The PNLP to track net ownership, gaps in coverage, and new sleeping spaces through a national household database regularly updated by CHWs.
- The PNLP to conduct behavior change communication (BCC/IEC) to increase proper use of LLINs.
- The PNLP to develop guidelines on personal protection for travelers.
- The PNLP to monitor the physical condition of LLINs and residual efficacy of distributed LLINs.
- The PNLP to institute adequate planning for procurement and replacement of LLINs after every three years or at a time interval to be established through the on-going LLIN field effectiveness study.
- The PNLP to liaise with WHO on the environmentally safe disposal of old LLINs
- The PNLP, in close collaboration with relevant partners, to conduct BCC/IEC campaigns to discourage misuse of LLINs by communities for other purposes such as fishing or chicken housing.

#### Indicators

- National LLIN distribution guidelines in place.
- Number of LLINs distributed.

- Percent of population receiving with LLINs.
- Percent of population using LLINs at night.
- Personal protection guidelines for travelers in place.
- Longitudinal evaluation of LLIN field performance.
- An LLIN procurement plan and resources available.
- Number of old nets stockpiled for sound disposal.

### 3.4.2 Indoor Residual Spraying (IRS)

Burundi currently implements IRS in selected highland provinces that are prone to epidemic outbreaks (Section 1.2).<sup>2</sup> A national strategy has been drafted specifically for IRS, which provides detailed information. A summary of important points in the IRS strategy are included in this IVM strategy.

Consistent with the goals of the National Malaria Strategic Plan to halve malaria morbidity and mortality by 50% from 2000 and by a further 50% by 2015, the strategic objective for IRS implementation in Burundi is to *Implement ecologically sound, cost-effective and sustainable indoor residual spraying to control malaria, based on sound local evidence on disease eco-epidemiology.*

The specific objectives of the national IRS implementation are:

- (i) *To scale up IRS* to protect the population in eight high-elevation provinces of Burundi (Gitega, Karusi, Kayanza, Muramvya, Muyinga, Mwaro, Ngozi and Cankuzo) with the aim to prevent and control outbreaks of malaria epidemics.
- (i) To complement LLIN intervention with IRS in certain endemic lower regions of the country such as Bubanza, Cibitoke, as well as parts of Bujumbura in the environs of Lake Tanganyika, to further reduce malaria morbidity and mortality.
- (ii) *Strengthen and maintain appropriate and sufficient human, technical and infrastructure capacities for IRS.* Efforts in this direction will be within the context of strengthening relevant competencies for implementation of the national IVM strategy.

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<sup>2</sup> An IRS Specific strategy has been developed covering 2012 -2017, which provides detailed information.

- (iii) *Establish a national scheme to effectively manage the development of resistance to WHOPES approved insecticides among the local malaria vector populations.*

Currently IRS operations are limited to selected areas (communes) in about three districts and the impact of IRS operations has been less than desirable. The primary goal for IRS implementation, therefore, is to fully achieve specific objective one in the short term and to draw lessons towards fully achieving specific objective two, in the medium term. Efforts regarding specific objective two will be informed by the relevant guidance of WHO on the co-deployment of IRS and LLINs, to ensure both cost-effectiveness and efficient use of resources, as well as maximal disease level impact. Robust M&E is therefore necessary to determine the appropriate combination that is most cost-effective and sustainable.

Normally, coverage of IRS should be very high in the targeted geographical area, for maximum effect. The operational target of IRS implementation will therefore be as close to 100% coverage of the sprayable structures in the targeted geographical areas, as possible.

#### Selecting IRS target sites and determining spray rounds

Scaling up within the highland areas Recognizing that additional funding will need to be mobilized to cover all of the eight highland provinces that have been identified for IRS implementation, the scale up of the intervention will be informed by the following factors

- i. *Areas with highest malaria burden*—regions around the swamp zones and bordering the areas of irrigated rice and mixed farming where burden is traditionally highest.
- ii. *Under-served areas, in terms of access to health services*—Priority will be given to areas with least access to health facilities.

With those highland areas, decisions on the geographical prioritization for IRS are expected to change over time, as the local eco-epidemiology of malaria changes. For example epidemic predictions tools may indicate a shift in the location of potential outbreaks and this should elicit the appropriate response at the time. Consistent with the core IVM principle of ensuring that local evidence forms decisions on vector control, this IVM strategy therefore does not prescribe or anticipate decisions of modifying the timing and geographical targeting of IRS operations. Such future decisions will aim at maximum protection the highest number of persons most at

risk, given the available resources. A guiding principle will be soundness of the ecological basis of future decisions, and cost-effectiveness and sustainability of the interventions. Hence some of the factors that should be considered in such decision include the:

- Levels of susceptibility of vectors populations in the targeted area to the selected WHOPEs approved insecticides,
- Length of residual effectiveness of the insecticide, compared with the length of the local malaria transmission.

IRS operations will be backed with reliable monthly residual efficacy evaluations through standardized WHO wall bioassays, to establish the actual field performance of IRS insecticide(s) on the major targeted surface types in the area (cemented unpainted, cemented and painted, soil, thatched, or wood, as the case may be). A desirable objective will be to use a WHOPEs recommended insecticide to which the targeted vectors show the least tolerance (whole susceptible) and which has the longest residual efficacy. In that regard, opportunities will be explored accelerate access to newer insecticide products with longer residual efficacies.

*Timing of spray operations:*

IRS is best conducted at the tail end of the drier period and just preceding the onset of the rainy season. This is to enable the period of maximum residual efficacy (and thus the period of maximum killing effect) to coincide with a peaking of the local malaria transmission risk, which normally follows the onset of the rains. Up-to-date historical knowledge on local rainfall patterns is necessary to improve the timing of operations.

In the highland provinces where the objective is to prevent and control epidemic outbreaks in the highlands, IRS operations will be timed to precede the periods of the year when outbreaks normally occur. National capacity, in the meantime, will be strengthened to enable robust epidemic prediction to ensure that the deployment of the intervention is increasingly timely, more efficient, cost-effective and has maximum impact on preventing or suppressing outbreaks.

For the purposes complementing LLINs utilization in selected lowland areas (re: IRS specific objective two above), normally, there will be a lead time for effective preparations (e.g. training and transporting spray operators, procurement of equipment and accessories and insecticides; IEC/BCC targeting community and households on compliance). Done within a context of a universal coverage of LLINs in the lowland areas, it will be increasingly prudent that IRS deployment is informed by clear demonstration of cost-effectiveness.

### Selection of insecticides for IRS

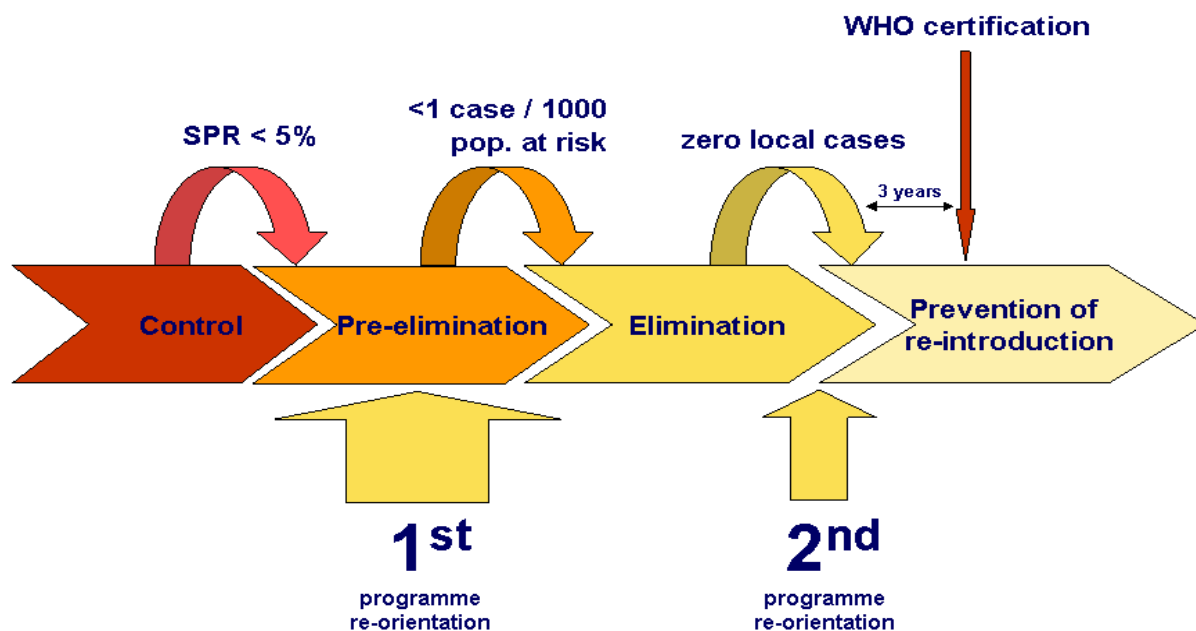
- Only WHOPES recommended insecticides will be used for IRS. Selected pesticides must be registered in the country for that purpose. Where a preferred insecticide is not registered, the full national requirement for registration will be fulfilled, before it is imported, unless a duly authorized national agency grants a temporary exemption under emergency conditions.
- Insecticide reformulations with longer residual efficacy, or new class(es) of recommended insecticides entering into the market place, will be evaluated for local suitability to provide viable fall back options for resistance management.
- In order to be selected for IRS, the local vector populations in the targeted areas must be determined to be susceptible to the insecticide formulation, using standardized WHO or CDC protocols on susceptibility. If resistance exists then an insecticide with a different mode of action will be used as part of resistance management strategy. Decisions will be informed by the current guidance of WHO, as well as related outfits such as the Insecticide Resistance Action Committee (IRAC).
- The cost of an insecticide, as well as associated peculiar operational costs (e.g. bulk or specialized environmental safety requirements), will form part of the criteria informing final decisions on selection. Other factors may include comparative acceptability by targeted households (e.g. malathion, may have peculiar smell which some communities take for potency and actually promote acceptance by households, while in other communes could serve to undermine acceptance).

### Configuring IRS operations in pre-elimination of malaria transmission

It is anticipated that as IRS is deployed effectively, transmission will continue to be reduced. For portions of the highland areas, it is possible that some areas may experience a pre-elimination phase of malaria. Pre-elimination stage is achieved when the test positivity rate (TPR) from fever cases that are reported in the health facilities reach less than 5% (Fig. 3). This stage in disease reduction will however require:

- Intensified preventive measures, early detection and prompt management of all malaria cases, and behavior change communication. To forestall the resurgence of malaria transmission, the pressure exerted to break the transmission cycle must be sustained.
- The objective of IVM will be to utilize a strengthened epidemic prediction and early detection tools to prevent or reduce the spread of disease from areas of residual transmission or new active foci, back into areas where transmission has previously been disrupted.

*Fig. 3: From malaria control to elimination*



*Source: World Malaria Report 2009*

- Appropriate country capacity in entomology and epidemiology will be required to assess residual transmission and quickly detect outbreaks; environmental precursors of epidemic outbreaks in highland areas, such rainfall, temperature and changes in land use, will need to be identified and tracked to enable good prediction of potential outbreaks.
- Where outbreaks actually occur, the goal will be to reduce the time between the detection and validation of field data (confirmation of an outbreak) on one hand, and appropriate and timely response (the deployment of appropriate interventions) to prevent or control the outbreak.

- Provinces and districts will be adequately prepared as part of epidemic prevention and response strategy. For IRS operations this means that stocks of all relevant IRS equipment, supplies and insecticides will need to be read and on standby in the province and districts—together with trained IRS teams—ready to be mobilized and on location at short notice.
- IRS operations will need to be decentralized, ceding responsibility for field operations and supervision to the provinces and districts, with the central level (PNLP) providing time-sensitive epidemic confirmation and guidance, insecticide monitoring, quality control, and M&E functions. Capacities and decision making processes will need to be appropriately decentralized to allow for timely action at the province and district levels to reduce the lag time between early detection of a malaria outbreak and the deployment of interventions (this is currently done from the central level and will need to be modified appropriately).

#### Major Action Points for IRS Implementation

- The PNLP will develop an IRS-specific strategy consistent with the guidance in this IVM strategy.
- The PNLP will conduct monthly wall bioassay tests to evaluate the levels and length of residual efficacy of IRS insecticides. Results obtained will form part of the information base that informs the selection of insecticides for IRS operations.
- The PNLP will conduct annual vector susceptibility tests to WHOPES approved insecticides at selected sentinel sites following procedure outlined in Section 3.4.4
- PNLP will coordinate with relevant national stakeholders, to develop a national strategy to monitor and manage insecticide resistance in local malaria vector populations (Section 3.4.4).
- The MOPH will ensure adequate stocks of insecticides, pumps and PPE for rapid deployment to prevent and control malaria epidemic outbreaks.
- The PNLP and partners will support maintenance and service workshops for spray pumps and soak pits.
- The MOE and MOPH will ensure that all IRS operations are compliant with best practices and relevant recommendations of WHO and FAO, to safeguard the environment and human health.

- As appropriate, PNLP will decentralize IRS operations and build capacity at province and district levels for cost-effective operations.

#### Related Indicators

- A national IRS strategy in place and operational.
- Percent of targeted structures covered with IRS in target areas.
- Percent of targeted population protected by IRS in target areas
- Amount of insecticides used.
- Insecticide resistance profile known.
- National policy on pesticide management strengthened.<sup>3</sup>
- Compliance with international standards on safe pesticide handling (e.g. percent of pesticide handlers using appropriate PPE; percent of IRS districts with pesticide storage places, trained storekeepers).
- Compliance with international standards on safe disposal of insecticide contaminated waste.
- Number of people trained on the safe use of pesticides.
- Amount of resources allocated for IRS.

### **3.4.3 Larval Source Management (LSM)**

There has been no evaluation of the cost-effectiveness of LSM for malaria control in Burundi. However, there is evidence that about 80% of the epidemic outbreaks in the highland provinces occur around irrigated rice and mixed-farming areas, where the irrigation creates and sustain breeding sites (MOPH, 2009). Water management (i.e. intermittent irrigation to manipulate water levels and irrigation frequency) has been shown to significantly reduce vector densities and control malaria transmission in African rice fields (Kaiser, 2002; Klinkenberg, 2003; Walker and Lynch, 2007). The utility and cost-effectiveness of LSM must be carefully evaluated, preferably on a pilot basis to inform subsequent policy. This will make sure that any investment made in LSM is done with a right perspective on cost-effectiveness and sustainability. LSM may

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<sup>3</sup> Following SWOT analysis the NISC is expected to make recommendations, as required for strengthening policy.



include the use of biological agents such as larvivorous fish and *Bacillus thuringiensis israelensis* (Bti), as well as chemical agents.

#### Major Action Points for LSM

- PNLP to coordinate ecological evaluation to identify and map vector breeding habitats
- Pilot evaluation of LSM to determined utility as complementary intervention to IRS in highland areas

#### Indicators

- Maps of major larval breeding habitats available.
- Study of cost-effectiveness of LSM conducted.

### **3.4.4 Insecticide Resistance Management**

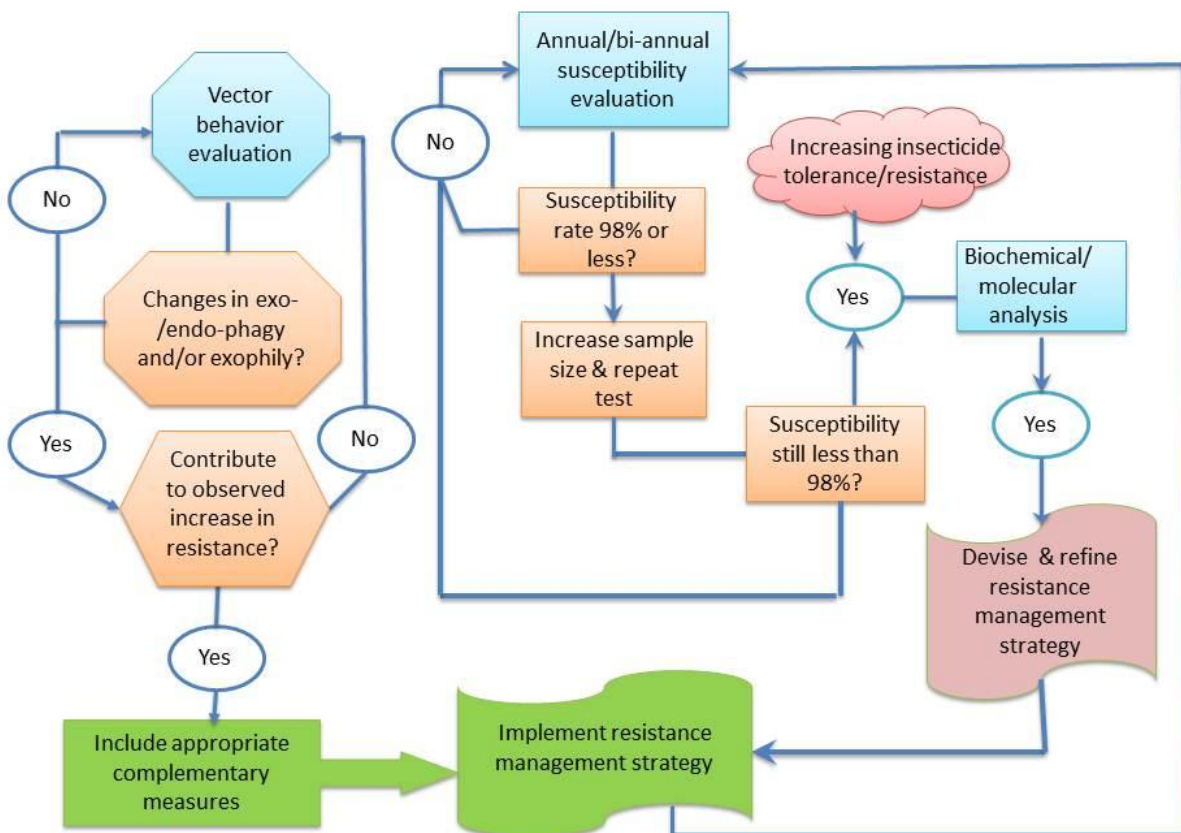
A primary consideration in national IVM implementation in Burundi, will be the development of a strategy to effectively manage insecticide resistance in malaria vector populations. The scale up of insecticide-based vector control interventions (IRS and LLINs), will increase the selection pressure for resistance in the vector populations especially given the high use of similar pesticides in agriculture. Although there have been very recent efforts to increase the entomological capacity of the PNLP with the establishment of an insectary and retraining of the entomology technicians, overall national capacity for entomological surveillance and monitoring is still inadequate, particularly in the provinces and districts. Additional investment will be made to establish a robust sentinel-based scheme to support national IVM efforts. Strategic partnership will be formed between the PNLP, and other research and academic outfits in the country, to mobilize all available national resources and skills for this endeavor. There is currently a paucity of information on the levels and distribution of resistance and this constrains the establishment of a viable resistance management scheme.

Assessing resistance mechanisms: The development of insecticide resistance in the local vector(s) of malaria is a direct threat to the continued utility of the current vector control tools LLIN and IRS in Burundi, with potential to reverse any gains made. Using standardized WHO or CDC protocols, PNLP will evaluate the susceptibility of local malaria vector to the current WHOPES approved insecticides within the IRS provinces and districts. It will also include

susceptibility (vector knock down) evaluations on distributed LLINs, as part of a comprehensive evaluation of the field performance of the various LLINs. The performance evaluations will enable the PNLP develop net replacement strategies. The establishment of a central insectary at Gihanga, coupled with the incorporation of the laboratory facilities at NIPH, will further strengthen national entomological capacity—enabling the initiation of biochemical/molecular monitoring of resistance mechanisms within local vector populations. Fig. 4 proposes a scheme for resistance monitoring. A determination of a susceptibility thresholds of less than 98% will trigger annual biochemical/molecular evaluations of resistance mechanisms [Knock down resistance (*kdr*), Glutathione and Glutathione-S-Transferase (GSTs), Cytochrome P450s, Esterases, Acetylcholinesterase (AChE) or Modified Acetyl Cholinesterase (MACE), and Gamma-Amino Butyric acid (GABA)], using either TaqMan Plasmodium Assay or Polymerase Chain Reaction (PCR)].

*Using Resistance Monitoring results:* The bio-molecular evaluations will establish the local drivers of observed resistance (or lowered tolerance) and inform the selection of insecticides with a different mode of action to manage resistant strain(s) within local vector populations. National efforts will be guided by existing recommendations of WHO, Insecticide Resistance Action Committee (IRAC) and other sources on insecticide resistance management. Methods could include rotation of different classes of insecticides and mosaic application of different classes of insecticides. The improved knowledge from the evaluations will enable effective approaches, such as the timing/sequencing and geographical targeting of the insecticides. Findings from this evaluation will be part of the IVM information systems discussed under Section 3.7.3.

Fig. 4: Resistance monitoring and management scheme



As a result of cross-resistance, insecticides sharing a common target site (e.g. DDT and pyrethroids) should not be rotated back-to-back. Preference will be given to insecticides with different modes of action such as a carbamate or an organophosphate. In case of emergency, such as a sudden upsurge of insecticide resistance to available insecticides of choice, then as part a resistance management efforts, appropriate consultations will be undertaken and legitimate approval granted for limited or temporary use of a new insecticide of a different mode of action evolved under the Innovative Vector Control Consortium (IVCC) and awaiting full recommendation by WHOPES.

**Frequency of Resistance Monitoring Tests:** A six-monthly susceptibility test schedule will be established, where there is pre-existing tolerance, to provide better monitoring of susceptibility. Otherwise, once annual evaluation will be adequate. National data on vector susceptibility/

resistance will be routinely shared with WHO to facilitate region-wide insecticide resistance management strategies.

#### Major Action Points on Insecticide Resistance Management

- The PNLP to conduct a comprehensive entomological baseline and periodic update, to establish an up-to-date country profile on the local vectors of malaria and their geographical distribution.
- PNLP to conduct annual evaluation to establish the status and distribution of the susceptibility of malaria vectors to WHOPES recommended insecticides using standardized WHO or CDC protocols. Evaluations will be linked to a national sentinel-based surveillance system.
- PNLP to collaborate with NIPH and other research and academic partners to undertake PCR-based evaluations to establish the insecticide resistance profile and recommend appropriate interventions within the context of a national resistance management plan.
- The PNLP to monitor the residual efficacy of insecticides on sprayed structures in IRS, and for distributed LLINs in the field using standardized WHO protocols.
- PNLP in close coordination with NSIC will establish an insecticide resistance management scheme.

#### Indicators

- National profile on local malaria vectors
- A functional insecticide resistance management plan
- Annual reports on insecticide susceptibility evaluations
- Reports on biochemical/molecular evaluations of resistance mechanisms
- Annual review of insecticide resistance data by the MOPH and NISC for evidence-based decision making on insecticide selection and resistance management
- Collaboration with international laboratories and organizations on insecticide resistance

### **3.5 Strengthen Infrastructure for Entomological Monitoring**

A national entomological sentinel system will be established for systematic surveillance and monitoring to inform national IVM implementation. Data collected at sentinel locations will include vector density, resting behavior, species composition, larval habitats, vector infectivity

rate, blood feeding index, parity, etc. These sentinel locations will also serve to capture eco-epidemiological data relevant to establishing the drivers of malaria transmission in the country.

A central insectary and associated entomology laboratory at Gihanga, together with facilities at the NIPH, will serve as fulcrum for enhanced for national evaluation of the full range of entomological evaluations. PNLP will coordinate assessments to be carried out by field sentinel stations (ref: Section 3.7.1).

#### Major Action Points on Entomology Capacity Strengthening

- The PNLP will establish and strengthen sentinel sites in different eco-epidemiological zones for entomological monitoring (Table 9). This will be done within the context of devolving appropriate capacities and activities to the provinces and districts for vector control.
- The PNLP in close partnership with NIPH to strengthen capacity for ELISA- based and molecular PCR techniques, to enable a full range of entomological monitoring activities.
- The PNLP to support entomological and epidemiological data collection and reporting through the HMIS.

#### Indicators

- National vector distribution map updated.
- Insecticide resistance profile updated.
- Qualified technicians in charge of sentinel sites.
- Number of sentinel sites with fully functional vector surveillance and susceptibility monitoring.
- Functional insectary and associated entomology laboratory used for evidence-based decision-making.
- Reliable entomological and epidemiological data from the different eco-epidemiological zones available in HMIS for evidence-based decision-making.

### **3.6 Strengthen Human Capacity for IVM implementation**

Vector control functions will be clarified at the various levels of program administration (central, province, and district) to help identify the skills and competencies sets needed for effective IVM

implementation. This will include roles and functions for the health sector as well as for other sectors. Table 8 outlines some generic functions. Within the context of intersectoral collaboration, MOPH will provide leadership to developing relevant competencies in other sectors and stakeholder partners so that they are able to undertake their functions effectively.

Entomological, epidemiological and environmental skills will be required to provide overall strategic and technical guidance for planning, implementation, monitoring and evaluation of IVM strategy. There will be level-appropriate training on vector-borne disease epidemiology, surveillance and control interventions. Based on the WHO core curriculum and other training resources on IVM, national training manuals will be developed and training opportunities in entomology surveillance and insecticide management expanded to develop adequate numbers of trained human resources to support IVM implementation and evaluation. MOPH will collaborate with the Ministry of Education and Scientific Research (MOESR) to enhance advance training in priority areas to sustain national transition to IVM.

Dedicated IVM coordination teams will be established or strengthened in the provinces and districts to support inter-sectoral action and to oversee IVM implementation.

#### Major action Points of Human Resource Strengthening

- The PNLP to develop comprehensive vector control functions at the central, province and district levels, and clarify corresponding staff competences and skills requirements.
- The PNLP to collaborate with partners to establish training opportunities and create adequate numbers of trained national human resources in the various categories of vector control skills and competencies required for effective IVM implementation.
- The MOPH to facilitate training opportunities on IVM to staff from stakeholder sectors to facilitate competent stakeholder contributions to IVM implementation.
- The MOPH to train District Health Teams and community focal points to conduct disease surveillance, data management, reporting and epidemic preparedness and response.

*Table 8: Core functions at different administrative levels of national vector control*

<b>Central Level</b>	
<ul style="list-style-type: none"> <li>• Strategic direction to programs</li> <li>• Policy development</li> <li>• Standard settings, norms and M&amp;E indicators</li> <li>• Programme funding/resource mobilization</li> <li>• Prioritize and allocate financial resources</li> <li>• Epidemiologic analysis</li> <li>• Quality assurance</li> <li>• Training and support for county/sector programs and vector control</li> </ul>	<ul style="list-style-type: none"> <li>• Coordination of emergency response</li> <li>• Evaluation &amp; validation of operational research</li> <li>• Decision making and planning of region programs and activities</li> <li>• Determine human resource needs</li> <li>• Monitor and evaluate IVM implementation</li> </ul>
<b>County and districts</b>	
<ul style="list-style-type: none"> <li>• Local planning of implementation</li> <li>• Resource prioritization and allocation</li> <li>• Disease surveillance</li> <li>• Programme monitoring</li> <li>• Health education</li> </ul>	<ul style="list-style-type: none"> <li>• Train field staff and village health volunteers</li> <li>• Undertake vector control activities, assist in operational research</li> <li>• M&amp;E: collection and initial collation of local data on various vector control aspects</li> </ul>

### Indicators

- Number of personnel positions with clarified job descriptions that make reference to IVM.
- Training curriculum on IVM in place and used.
- Number of persons trained on IVM strategy.
- Number of persons trained in the various skills and competency areas in IVM.
- Number of targeted communities implementing vector control activities.

### **3.7 Generating Data for Evidence-Based Decision-Making**

Under the auspices of the NISC, a Vector Control Working Group (VCWG), serving as a sub-committee, - will identify and undertake priorities in operational research to generate relevant information for decision-making. The focus will be improving the efficacy, cost-effectiveness, ecological soundness and sustainability of vector control efforts. Strategic partnerships will be established with national research institutions and universities to mobilize relevant national capacity for operational research. Critical issues may pertain to: (i) the timing and geographical targeting of IRS within a national context of universal coverage of LLINs and anticipated reductions in transmission, ii) evaluation of the field performance of the various LLINs, and (iii)

the role of larval source management (environmental management, sanitation and larviciding) in malaria vector control in Burundi.

As necessary, other operational questions will be identified by the NISC. Proposals will be developed and studies conducted in collaboration with academic and research partners, both within and outside of the country.

#### Major Action Points of Evidence Generation

- The PNLP to enhance collaboration with regional and international research institutions on operational research.
- NISC to establish a VCWG, as one of its sub-committees to provide expert counsel on quality control of vector control tools and products (insecticides, LLINs, LSM, spray pumps, personal protection equipment etc.).
- The VCWG to identify programmatic issues and gaps in knowledge and operations that require surveys and/or operational research for consideration by PNLP and NISC.
- The PNLP will conduct investigations on the ecology and behavior of malaria vectors to update information on local mosquito vectors of malaria and other vector borne diseases such as lymphatic filariasis.
- The PNLP to assess the strategy for IRS deployment and the effectiveness of implementation with regards to the two main objectives of a) preventing and controlling epidemic outbreaks in the highland provinces and b) as a complementary tool in selected lowland areas, co-deployed with LLINs.
- The PNLP to assess the feasibility and cost-effectiveness of LSM for vector control as an integral part of a broader strategy to control malaria vectors.
- The MOPH and VCWG will conduct entomological and epidemiological surveys of other vector borne diseases in the country.

#### Indicators

- Number of priority operational research priorities addressed.
- Number of research collaborations between PNLP and research institutions.
- Number of research outcomes used for decisions and updating policies, guidelines and work plans.
- Information on the ecology of malaria and other vector borne diseases in the country available.
- Report on the outcomes and effectiveness of the various vector control.



- Report on the cost-effectiveness and impact of national IVM implementation.

### **3.7.1 Entomological Monitoring**

A national sentinel-based entomological surveillance and monitoring system will be established to provide an ongoing, evidence-base for decision making. The sentinel system will have the following characteristics:

- i. A central insectary and associated entomology laboratory at Gihanga, to coordinate field sentinel stations to undertake a full range of evaluations in support of malaria vector control.
- ii. Collaboration with laboratory facilities in NIPH, Bujumbura to undertake bio-molecular evaluation of resistance mechanism to inform national resistance management.
- iii. An adequate number of well-trained field and program level staff for the required entomological evaluations and evidence generation. In 2012, training was conducted for staff of the PNLP/Vector Control Unit on basic entomological surveillance and monitoring methods. These technicians will be supervising and coordinating national entomological evaluation. Additional opportunities will be explored to provide training in advanced methods in entomological surveillance.
- iv. Standardized protocols and indicators will be clarified to drive a national vector surveillance and monitoring scheme. Entomology sentinel locations will be established and staffed by trained field entomology technicians (ref: Table 9) to collect relevant data on the major eco-epidemiological settings of malaria transmission in the country. A national scheme on entomological surveillance and monitoring will be established to track local vectors and evaluate impact of ongoing vector control interventions on disease transmission.
- v. A vector control information system will be established for efficient and timely data collection, management and utilization. This information system will ultimately be incorporated in the national Health Management Information Systems (HMIS), to facilitate decision making on malaria control.

*Table 9: Basics of Entomology Sentinel System*

- A national entomology sentinel system will be established, comprised of a central insectary/entomology laboratory at Gihanga, laboratory facilities at the NIPH and sentinel field stations representing the major ecological zones for malaria (highlands, highland-irrigated areas, lowland forest, lowland riverine, urban/peri-urban etc.).
- The number and location of the sentinel sites will be guided by subsequently developed and periodically updated criteria, ensuring coverage of (a) major ecological zones in the country, (b) potentially isolated vector populations due to geographical barriers and (c) areas with known reduced insecticide tolerance or resistance.
- The sentinel sites will undertake monitoring and surveillance (ref: Table 10) on local malaria vector populations in defined geographical locations, using standardized and internationally recognized methodologies/protocols by WHO and CDC (bottle assays).
- Other ecological/environmental factors with direct impact on the vector populations (e.g. rainfall, temperature) will also be recorded.
- Data generated will focus on vector ecology, vector population structure and distribution, and spatial and temporary changes in species, disease transmission related behavior (biting and resting preferences), efficacy and effectiveness of vector control intervention employed to control malaria.
- Sentinel sites will be staffed by formally trained entomology field technicians (two and a supervising technician) with proficiency on required methodologies and assessments to be conducted at the site. The technicians will be literate (with previous technical or secondary education) and able to document data, read and understand simple instructions in the official national language.
- The sentinel sites will have basic equipment and supplies, such as microscopes, insect cages and dissecting kits, to conduct assessments.
- The technicians will be guided by detailed and user-friendly sentinel site (field) manuals. As needed, they will mobilize and train persons in nearby communities to provide temporary support to field assessments as may be described in the sentinel site manuals.

### **3.7.2 Epidemiological information**

The PNLP routinely collates health facility-based, parasitologically confirmed monthly morbidity and mortality data. The epidemiological data will be combined with vector control data (entomological data and other parameters) to more effectively target and then monitor the impact of IVM.

Table 10: Desirable entomological monitoring indicators

<b>BASIC entomological evaluations (measured monthly) – Category 1 (sentinel sites):</b>
<ul style="list-style-type: none"> <li>i. <i>Insecticide residual effectiveness (cone bioassay)</i> – on major wall surface types (mud, cement–painted or unpainted--and wood) in the localities where indoor residual activity is conducted and on LLINs. Provides rate of decay of the insecticide determined for (a) IRS by 24 hour mortality of mosquitoes exposed to sprayed walls for 30 minutes and (b) for LLINs as 24 hour mortality of mosquitoes exposed to LLINs for 3 minutes.</li> <li>ii. <i>Human landing catches (indoor &amp; outdoor)</i> - provides insight into biting behaviour of local vectors</li> <li>iii. <i>Pyrethrum spray catches</i> – Done between 6 a.m. and 8 a.m. at pre-selected houses. Indicator provides insight into vector entry into sprayed rooms over time. Compared with unsprayed homes and other higher category 2 evaluations on the catches (e.g. parity, sporogony, and blood meal analysis) provides insight on effectiveness of intervention and indicate transmission risk changes in sprayed rooms.</li> <li>iv. <i>Species identification (morphological) and composition</i> - from monthly catches listed above. It will enable mapping of vector distribution and tracking of any changes in species composition within the year.</li> <li>v. <i>Insecticide susceptibility evaluation (CDC) bottle assay or WHO tube-assay</i> - 2x/year for WHOPES approved insecticides</li> </ul>
<b>Entomological evaluations - Category 2 (Insectary/Entomology laboratory at Gihanga and laboratory facilities at NIPH, Bujumbura)</b>
<p>The Category 2 evaluations require advance training and access to relevant ELISA and PCR equipment.</p> <p>The following indicators will be assessed:</p> <ul style="list-style-type: none"> <li>i. <i>Sporozoite rates</i> (quarterly) - provides insight into risk of getting malaria</li> <li>ii. <i>Entomological inoculation rates</i> (quarterly) – measure risk of getting malaria through infected bites</li> <li>iii. <i>Blood meal analysis</i> (half yearly) – provides insight into feeding preference of mosquito vector</li> <li>iv. <i>Age grading</i> evaluations (quarterly) – especially from room catches denotes the effective intervention is in killing off vectors</li> <li>v. <i>Resistance mechanism</i> by molecular techniques (annually)</li> </ul>

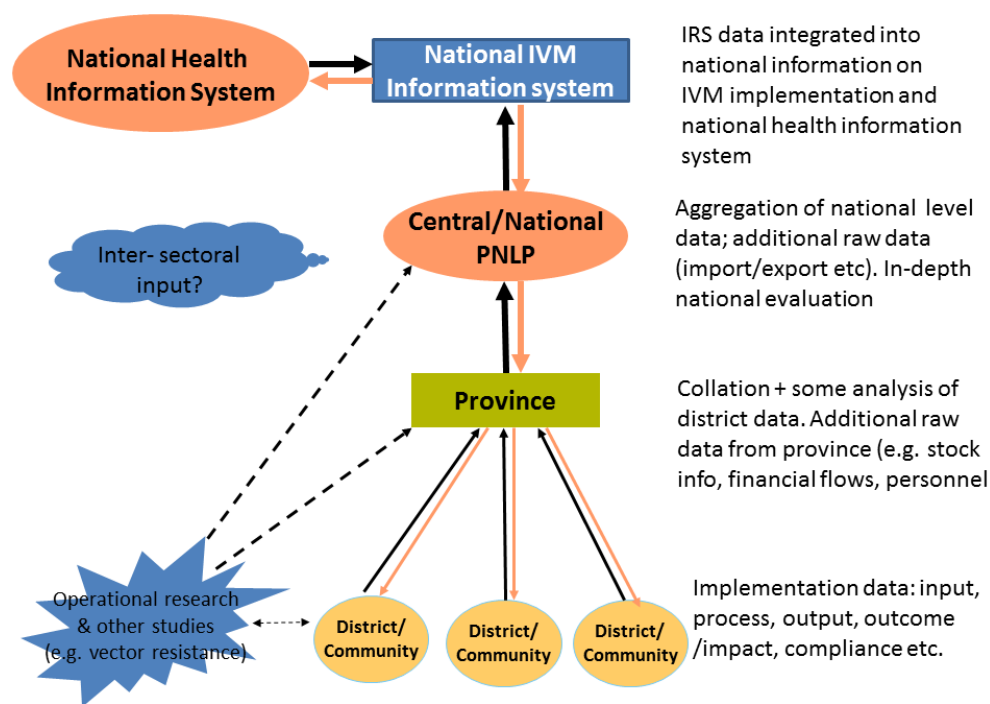
### 2.7.3 Information management for IVM

Relevant infrastructure will be established to ensure timely information management and dissemination for effective IVM implementation (Fig. 5). The information system will form an integral part of national health information system, ensuring effective decision making on the

control of malaria and other VBDs. The Information system will have the following characteristics:

- i. Appropriate and adequate technical and infrastructural capacities established at the central, provincial and district levels for timely collection, management and utilization of locally relevant data for decision-making.
- ii. Well defined indicators and frequency of measurements (input, process, output, outcome and impact) documented and disseminated to all relevant staff to harmonize efforts and ensure comparability of data sets.
- iii. Functional data quality review and protection measures to assure the integrity of information the points of collection/measurement through to the point of interpretation and use.
- iv. Regular dissemination of level-appropriate information at all levels of national IVM implementation for timely decisions and continuous improvement of disease outcomes and impact. VCWG as a sub-committee of the NISC, to assist with technical input to the IVM policy review mechanism of the NISC.
- v. There will be timely utilization of gathered scientific data in advocacy and communication targeting various stakeholders.

*Fig. 5: Potential routes for vector control data collection/management*



### **3.8 Monitoring and Evaluation of IVM Implementation**

The process and outcome indicators listed under the various sections in this strategic plan, will form part of datasets utilized by the PNLP and the NISC for M&E of IVM implementation. This exercise will be facilitated by the national IVM focal point, the VCWG and the NISC, who share responsibility for documenting and reporting the achievements, challenges and bottlenecks in national IVM implementation.

#### **Major Action Points for M&E on IVM Implementation Progress**

- The PNLP and the NISC to monitor and evaluate progress on the IVM strategy in terms of achievements, constraints, resource allocation against the set targets. A review to be done every six months in conjunction with stakeholders, partners and external reviewers.
- The MOPH and the NISC to assure best practices for IVM.
- The MOPH, with the coordination of the NISC, will collate data on progress and achievements and disseminate appropriate reports to policy makers, stakeholders and development partners.

#### **Indicators:**

- Number of coordination meetings held by the NISC.
- Certified progress reports.
- Decisions influenced by operational research.
- Strategy in place to ensure continuous mobilization of resources for vector control.
- Vector level impact indicators (vector infectivity/sporozoite rates, IER, biting rates)
- Percent reduction of morbidity and mortality due to malaria and other VBDs.

### **3.9 Resource Mobilization**

- i. The NISC will coordinate the development of a multi-year national work plan for IVM, based on the policy framework and strategy outlined in this document. This will be done through a process that enables stakeholder input and ownership of output. All aspects of IVM, including planning, managing, intervention deployment, staffing at the various levels (both long term and temporary field workers), training, monitoring and evaluation, and provision of critical infrastructure, will be detailed and budgeted. The roles and responsibilities of

sectors/stakeholders and partners will also be detailed. A full budgeting of a detailed work plan will: Improve the generation of relevant local data for rational decision-making, with reference to the policy objectives outlined in this strategy (Section 2).

- ii. Enable the development of a more comprehensive resource mobilization plan to:
  - a. Assist planning by government on the allocation of in-country resources.
  - b. Properly contextualize collaboration and support by the developmental partners, (e.g. USAID/PMI, Global Fund, World Bank, African Development Bank).
  - c. The PNLP and NISC will provide opportunities for partnership with the private sector, particularly with the agriculture and mining sectors, where malaria poses a significant threat to the profitability through disease-related absenteeism and reduced worker output.

#### Major Action Points for Resource Mobilization

- The PNLP and the NISC to develop a fully costed IVM work plan to estimate total cost of implementation of National IVM strategy.
- The PNLP and the NISC, to develop and implement a resource mobilization plan.

#### Indicators:

- Fully budgeted IVM strategy and work plan
- National IVM resource mobilization plan
- Proportion of annual IVM budget mobilized
- Number of funders (in-country and developmental partners) contributing to IVM implementation

## **4.0 CONCLUSION: IMPROVING HEALTH OUTCOMES IN VECTOR BORNE DISEASE CONTROL**

The policy framework and strategy will facilitate institutionalization of IVM and assure further reductions in mortality and morbidity. The IVM approach will be characterized by deliberate, learning and self-correcting efforts to continually improve on efficiencies and maximize outcomes and impact on disease transmission. The following outcomes are anticipated upon successful implementation of IVM in Burundi:

#### Policy outcomes

- Appropriate policy and institutional frameworks established for the control of local disease vectors, particularly malaria.
- Appropriate legislation and regulations established to protect human health and the environment in the development of natural resource (e.g. water, land), as well as the effective management and use of public health insecticides.

#### Programmatic/Operational outcomes

A learning and self-improving vector control implementation established in Burundi enabling cost-effective utilization of resources and characterized by:

- Elaboration of multi-year national IVM work plans that (i) enable coordinated national mobilization of resources, and (ii) improve the targeting of support from developmental partners, due to clarified national objectives and priorities for vector control.
- Effective inter-sectoral collaboration ensuring appropriate contribution by all stakeholders, including communities, in the management of the local vectors of malaria and other diseases.
- Adequate capacities established at central, provincial and district levels for evidence-based decision-making on vector control ensuring timely and adequate response to changing disease eco-epidemiology.
- Enhanced resource mobilization and stakeholder/partner contribution to IVM.

#### Disease level outcomes

- Ecologically sound, cost-effective and sustainable management of the local vectors of human diseases, especially malaria.
- Significant and sustainable reductions in the transmission of vector borne diseases, particularly malaria, resulting in reductions in morbidity and mortalities.

## 6.0 REFERENCES

1. Keiser, J., Utzinger J., and Singer B.H. (2002). The potential of intermittent irrigation for increasing rice yields, lowering water consumption, reducing methane emissions, and controlling malaria in African rice fields. *J Am Mosq Control Assoc.*18(4):329-40.
2. Klinkenberg E, Takken W, Huibers F, and Touré Y.T. (2003). The phenology of malaria mosquitoes in irrigated rice fields in Mali. *Acta Trop.* 2003 Jan;85(1):71-82.
3. Ministry of Health and Social Welfare, National Malaria Strategic Plan 2010 – 2015
4. MOPH (2009). Plan Strategique de Lutte Contre le Paludisme au Burundi 2008 -2012. Ministere de la Sante Public
5. MOPH( 2010) National malaria Programme Review
6. Ulrike Fillinger and Steven Lindsay (2011). Larval source management for malaria control in Africa. *Malaria Journal*, 10:353
7. van den Berg, Henk, and Takken Willem (2007). A framework for decision making in integrated vector management to prevent disease. *Tropical Medicine and International Health* 12, 1230-1238..
8. Walker K, and Lynch M. (2007). Contributions of Anopheles larval control to malaria suppression in tropical Africa: review of achievements and potential. *Med Vet Entomol.*;21(1):2-21
9. WHO 2003 Guidelines for vector control needs assessment. World Health Organization Regional Office for Africa, <http://www.afro.who.int/vbc/framework>
10. WHO (2004) Global strategic framework for integrated vector management. Geneva, World Health Organization, 2004 (WHO/CDS/CPE/PVC/2004.10).
11. WHO (2008) Statement on integrated vector management. WHO/HTM/NTD/VEM/2008.2). World Health Organization
12. WHO (2009) Report of the WHO consultation on development of a global action plan for integrated vector management (IVM). WHO/HTM/NTD/VEM/2009.1. World Health Organization.
13. WHO 2011a Guidance on policy development for integrated vector management. World Health Organization.
14. WHO 2011b Handbook on integrated vector management. World Health Organization.



15. WHO 2011c Core training curriculum on integrated vector management. World Health Organization.